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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/773,510	02/02/2001	Hirofumi Miyajima	046124-5064	3311

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EXAMINER	
MONDT, JOHANNES P	

ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 05/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/773,510	MIYAJIMA ET AL.	
	Examiner	Art Unit	
	Johannes P Mondt	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 February 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *11-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *11-14,16-20,22 and 23* is/are rejected.

7)☒ Claim(s) *15 and 21* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Response to Amendment

Amendment A filed 02/28/03 and entered as Paper No. 7 forms the basis of this office action. In Amendment A, Applicant canceled all outstanding claims 1-10 and added new and substantially different claims 11-23. Comments on Remarks by Applicant are usually restricted to those that can constitute a traverse of the rejections of the original claims. Since none of the rejections was specifically traversed on the merits of the cited art, nor on the basis of the obviousness arguments as presented with regard to motivation, combinability or reasonable expectation of success, no comments on said Remarks need to be included here.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. ***Claims 14 and 20*** are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claims contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. In particular, the insulating members 7 in the specification are disclosed to insulate the heat sinks from each other, but are not disclosed to be elastic. Only a material selection is indicated, namely: rubber.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. ***Claims 11-13 and 16*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al (JP409102568A) in view of Zengerle (DE 3436545) and either Kimura et al (JP408181392A) or Miyake (4,791,634). Please be referred to Figure 6 in Hayashi et al. Hayashi et al teach a heat sink for application to an electronic heat-producing device (cf. section [0001]) comprising:

a first planar member 34 having first and second faces opposite each other and having a first groove portion 34a-34h (see section in full text marked [0039]) in the first face thereof;

a second planar member 33 having first and second faces opposite each other and having a second groove portion 33a-33h (see [0039]) in a second face thereof; and

a partition 35 having a first surface and a second surface and disposed between the first surface of the first planar member and the second surface of the second planar member (see [0039]), wherein the first groove portion and the second face of the partition define a first space, the second groove portion and

the first surface of the partition define a second space, and the partition has a hole 35d (see also 2b on Figure 15) for communicating for communication between the first space and the second space (see [0039]);

a supply port 42d (see section [0047]) communicating to the first space for supplying a fluid into said first space; and

a discharge port 43d (see section [0047]) for discharging said fluid from the second space.

Hayashi et al do not necessarily teach the further limitation that (1) the face of said second planar member 33 that is formed with a second groove portion is a lower face, that (2) the electronic heat-producing device is a semiconductor laser device as delineated by lines 17-23 of claim 11, and (3) the heat sink material is copper.

However, ad (a): In substantially the same art, i.e., heat sink fir liquid cooling of semiconductor devices, Zengerle teaches that, in order to increase the surface area over which heat can flow to the heat sink, - and thereby increase the efficiency of the heat sink, said heat sink with grooves should be arranged such that the grooves face the semiconductor components, thus enabling an improvement. Combined with the configuration as taught by Hayashi et al, straightforward implementation of this particular teaching by Zengerle would automatically lead to the device of claim 1.

3. Ad (2) and (3): *As shown by Kimura et al* (JP408181392A), in a patent on semiconductor device bonding technology including the provision of heat sinks, in particular semiconductor laser devices bonded to copper heat sinks (cf. English abstract, "Constitution", first sentence and section [0052]), - and hence art analogous to

Hayashi et al, Kimura et al teach the attachment of a copper heat sink to a semiconductor laser device with first and second surfaces (upper and lower surfaces in Figure 1) opposite each other and mounted on the first face of a exterior planar member of a heat sink 21 (cf. Figure 3 and section [0028]) which thus can be identified with the second planar member of the claim; a first copper plate directly electrically in contact with p-side electrode 8 (cf. column 3, line 62 – column 4, line 4) and thus contacting the first surface of the semiconductor laser device; and a second copper plate directly contacting electrically the n-side electrode 9 (cf. column 4, lines 1-5 and column 10, lines 45-48) and thus directly electrically connecting the second surface of the first planar member such that said semiconductor laser device performs emission by application of a predetermined voltage between the first and second copper plates.

In the alternative rejection based on Miyake rather than Kimura et al, it is noted that the application of heat sinks to cool semiconductor laser apparatus has long been practiced in the art, as witnessed by Miyake, who teaches liquid-based cooling of a semiconductor laser diode array (cf. title, abstract and column 1, line 66 – column 2, line 5; and column 3, lines 18-21). Considering the teaching of Hayashi et al and Zengerle, their heat sink applied to a semiconductor laser apparatus mounted on an upper face of the second planar member is just a special case of the teaching of Hayashi et al and Zengerle of the heat sink of claim 1 as applied to a power semiconductor device as taught by Zengerle, while the special case of a semiconductor laser cooled by a heat sink based on liquid coolant has been taught by Miyake, hence long has been shown in the patent literature. Considering the power produced by semiconductor lasers ample

motivation exists to specifically apply the invention essentially taught by Hayashi et al and Zengerle not just to power semiconductor devices but to semiconductor laser devices in particular. The teaching in this regard by Miyake *combines* readily with the invention by Hayashi et al and Zengerle by simple choice of device to be cooled. *Success* in combining the inventions in this regard can therefore *reasonably be expected.*

Motivation to incorporate the teachings in this regard by Zengerle is the advantage of an increased capability of the heat sink to carry heat away from both planar members. All that is needed for combining the inventions in this regard is to apply the second groove portion to the *lower* face of planar member 33. Success in implementing the combination can therefore be reasonably expected.

Motivation to include the teachings of *Kimura et al* in this regard in the invention as taught by Hayashi et al is the provision of a heat sink for the electrodes of the semiconductor laser device, wherein the heat production is maximal (a major portion of the heat produced in a semiconductor laser device is ohmic), while an excellent bonding of the device to high-thermal-and-electrical-conductivity copper heat sink material, can be established for small dimensions (cf. column 1, line 54 – column 2, line 15 and column 4, lines 15-25). *Combination* of the teachings by Kimura et al in this regard with the invention by Hayashi et al is straightforward, because the heat sink by Hayashi et al aims to be applied to a semiconductor heat-producing device (cf. section [0001]), of which a semiconductor laser device is just an instance. *Success* of the implementation of said combination can therefore be reasonably expected. Finally, the examiner takes

official notice that the choice of copper for a heat sink is entirely obvious in view of the excellent conductivity properties of copper, as explained in textbooks on material physics.

With regard to claim 12: the partition comprises a plurality of holes opposite where the semiconductor laser device is mounted on the first face of the second planar member and arranged along a longitudinal direction on the area and in a row, said holes being 35a and 35c (see sections [0019] and [0039]). Therefore, the further limitation of claim 12 does not distinguish over the prior art taught by the primary reference.

With regard to claim 13: at least one of the aforementioned holes 35a and 35c taught by Hayashi et al has a cross-sectional area that evidently is small enough for injecting fluid into the second space such that when pressurized fluid is supplied from the supply port to the first space, the fluid is injected toward the predetermined area on which the semiconductor heat-producing device is mounted, because fluid is supplied to the supply port and reaches the area in which the semiconductor heat-producing device is mounted, as cooling said semiconductor heat-producing device is the objective of Hayashi's invention. Therefore, the further limitation as defined by claim 13 does not distinguish over the prior art as taught by the primary reference.

With regard to claim 16: As a logical consequence of the implementation of the teaching by Kimura et al or Miyake in the invention by Hayashi et al the active layer 4 in Kimura et al (cf. Figure 1), or, in the alternative, the active layer 12 within the diode portion 10 as taught by Miyake (cf. column 3, lines 30-40), contains a plurality of laser emission points arranged in a predetermined direction oriented so as to be substantially

parallel with the first face of the second planar member, which in itself is parallel to 9. Therefore, the further limitation of claim 16 does not distinguish over the prior art teachings of Hayashi et al, Zengerle and either Kimura et al or Miyake when combined as explained in connection with claim 11.

4. ***Claim 14*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al, Zengerle and Kimura et al as applied to claim 11 above, and further in view of Bell et al (GB1597829A). As detailed above, claim 11 is unpatentable over Hayashi et al in view of Zengerle and Kimura et al. Neither Hayashi et al, nor Zengerle, nor Kimura et al necessarily teach the further limitation as defined by claim 14. However, it would have been obvious to one of ordinary skills in the art of heat-producing semiconductor devices to insert an elastic medium between stacked heat sink components in view of *Bell et al*, who, for the purpose of providing both physical separation and mechanical cooperation between adjacent stack members in said stacked heat sink components 10 (cf. page 5, line 117), arrange an elastic (cf. page 4, lines 124-126) and insulating member (cf. page 4, lines 124-126) (cf. page 5, lines 3-12 and page 5, lines 117-123).

Motivation to include the teaching in this regard by Bell et al in the invention by Hayashi et al stems from the need to provide insulation but preserve flexible mechanical contact between subsequent stack members. *Combination* of said teaching with said invention is straightforward through insertion of an elastic, insulating layer in the stack taught by Hayashi et al. *Success* of the implementation of said combination can therefore be reasonably expected.

5. ***Claims 17-19 and 22-23*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al, in view of Zengerle, either Kimura et al or Miyake, and in view of Bell et al (GB1597829A). As detailed above in the discussion of claim 11, references to numerals and Figures of which are herewith included by reference, the following part of the claim is unpatentable over Hayashi et al, in view of Zengerle and either Kimura et al or Miyake:

a semiconductor laser apparatus comprising: a heat sink made of copper and comprising:

a first planar member 34 having first and second faces opposite each other and having a first groove portion 34a-34h (see section in full text marked [0039]) in the first face thereof;

a second planar member 33 having first and second faces opposite each other and having a second groove portion 33a-33h (see [0039]) in a second face thereof;

a partition 35 having a first surface and a second surface and disposed between the first surface of the first planar member and the second surface of the second planar member (see [0039]), wherein the first groove portion and the second face of the partition define a first space, the second groove portion and the first surface of the partition define a second space, and the partition has a hole 35d (see also 2b on Figure 15) for communicating for communication between the first space and the second space (see [0039]);

a supply port 42d (see section [0047]) communicating to the first space for supplying a fluid into said first space; and

a discharge port 43d (see section [0047]) for discharging said fluid from the second space;

a semiconductor laser having first and second surfaces opposite each other and mounted on the first face of the second planar member of the heat sink;

a first copper plate electrically contacting the first surface of the said semiconductor laser device; and a second copper plate electrically contacting the second face of the first planar member such that the semiconductor laser device performs emission by emission of a predetermined voltage between the first and second copper plates.

Hayashi et al, Zengerle and Kimura et al or Miyake when combined according to claim 11 and as explicitly detailed above do not necessarily teach the further limitation that a second semiconductor laser device be positioned between the second face of the first heat sink and the first face of the second heat sink, such that the first and second semiconductor laser devices perform emission by application of a predetermined voltage between the first and second copper plates.

However, said further limitation is automatically fulfilled when their invention is applied to stack the semiconductor laser apparatus of Hayashi et al, Zengerle and either Kimura et al or Miyake in series, such as the stacked series arrangement of semiconductor lasers referred to as prior art by Floyd (6,144,683) useful for obtaining different wavelength laser beams from the same stacked semiconductor laser array (cf.

column 2, lines 1-16). Said further limitation is thus merely an obvious application of the invention by Hayashi et al, Zengerle and either Kimura et al or Miyake.

Motivation to include the teaching by Floyd in said invention stems from the desirability to obtain different wavelengths from a single stack of semiconductor lasers and through a single current. *Combination* of said teaching and said invention is straightforward because all it requires is the stacking of the semiconductor laser apparatus with proper electrodes for series operation attached. *Success* in implementing the invention can therefore be reasonably expected.

With regard to claim 18: the partition comprises a plurality of holes opposite where the semiconductor laser device is mounted on the first face of the second planar member and arranged along a longitudinal direction on the area and in a row, said holes being 35a and 35c (see sections [0019] and [0039]). Therefore, the further limitation of claim 18 does not distinguish over the prior art taught by the primary reference.

With regard to claim 19: at least one of the aforementioned holes 35a and 35c taught by Hayashi et al has a cross-sectional area that evidently is small enough for injecting fluid into the second space such that when pressurized fluid is supplied from the supply port to the first space, the fluid is injected toward the predetermined area on which the semiconductor heat-producing device is mounted, because fluid is supplied to the supply port and reaches the area in which the semiconductor heat-producing device is mounted, as cooling said semiconductor heat-producing device is the objective of Hayashi's invention. Therefore, the further limitation as defined by claim 19 does not distinguish over the prior art as taught by the primary reference.

With regard to claim 22: As a logical consequence of the implementation of the teaching by Kimura et al or Miyake in the invention by Hayashi et al the active layer 4 in Kimura et al (cf. Figure 1), or, in the alternative, the active layer 12 within the diode portion 10 as taught by Miyake (cf. column 3, lines 30-40), contains a plurality of laser emission points arranged in a predetermined direction oriented so as to be substantially parallel with the first face of the second planar member, which in itself is parallel to 9. Therefore, the further limitation of claim 22 does not distinguish over the prior art teachings of Hayashi et al, Zengerle and either Kimura et al or Miyake when combined as explained in connection with claim 17.

With regard to claim 23: the semiconductor laser stack apparatus according to comprises:

a supply tube 48 connected to both of said supply port 42d of said first heat sink and said supply port of said second heat sink; and

a discharge tube 50 connected to both of said discharge port 43d of said first heat sink and said discharge port of said second heat sink,

because said supply and discharge ports and tubes are taught by Hayashi et al for the individual heat sink, while the implementation of the teaching by Miyake obviously would imply the presence of said supply and discharge ports and tubes for all heat sinks in the semiconductor laser stack apparatus.

6. ***Claim 20*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al, Zengerle, either Kimura et al or Miyake, and Floyd as applied to claim 17 above, and further in view of Bell et al (GB1597829A). As detailed above, claim 17 is unpatentable over Hayashi et al in view of Zengerle, Kimura et al or Miyake, and Floyd. Neither Hayashi et al, nor Zengerle, nor Kimura et al, nor Kimura et al or Miyake necessarily teach the further limitation as defined by claim 20. However, it would have been obvious to one of ordinary skills in the art of heat-producing semiconductor devices to insert elastic medium between stacked heat sink components in view of *Bell et al*, who, for the purpose of providing both physical separation and mechanical cooperation between adjacent stack members in said stacked heat sink components 10 (cf. page 5, line 117), arrange an elastic (cf. page 4, lines 124-126) and insulating member (cf. page 4, lines 124-126) (cf. page 5, lines 3-12 and page 5, lines 117-123).

Motivation to include the teaching in this regard by Bell et al in the invention by Hayashi et al stems from the need to provide insulation but preserve flexible mechanical contact between subsequent stack members. *Combination* of said teaching with said invention is straightforward through insertion of an elastic, insulating layer in the stack taught by Hayashi et al. *Success* of the implementation of said combination can therefore be reasonably expected.

Allowable Subject Matter

7. ***Claims 15 and 21*** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter: within the context of the art of the invention, the guide piece or riser, as disclosed (numerals 37 and 38 for said riser and guiding hole, respectively, in Figure 10; page 14, line 20), said riser raised from the upper planar member 16 has not been found in the prior art to date.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P Mondt whose telephone number is 703-306-0531. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 703-308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

JPM
May 14, 2003